Seat No.: ________ Enrolment No.______________

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –Ist SEMESTER–EXAMINATION – JULY- 2012

Subject code: 710201N **Date: 05/07/2012**

Subject Name: Computer Algorithm

Time: 2:30 pm – 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Compare and contrast the best case and worst case time complexities of bubble sort and quick sort with examples. Are they in-place sort? **07**

(b) 1) Solve the recurrence $W(n) = 2W(n/2) + n^2$ using recurrence tree method. **07**

2) Prove or disprove: The Master theorem can be applied to the recurrence $T(n) = 16\ T(n/4) + n!$

Give an asymptotic upper bound for this recurrence.

Q.2 **(a)** State whether the following statements are true or false. Justify. **07**

1) $n^2/2 - n/2 \neq \Theta(n^2)$

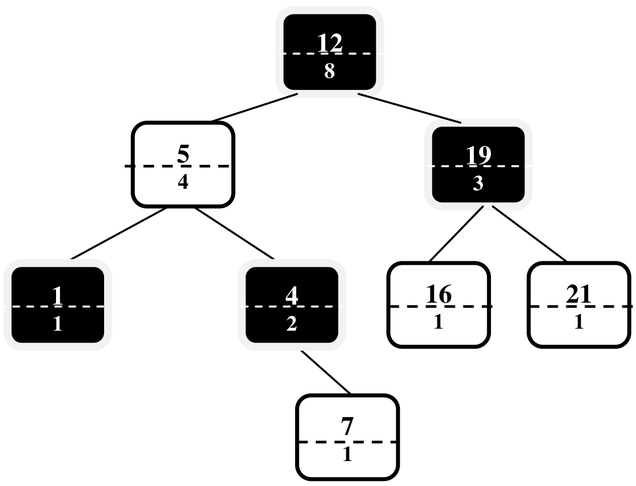
2) $100n + 5 \neq \Omega(n^2)$

(b) Construct AVL tree and Red-Black tree from given elements: **07**

52, 40, 36, 10, 23, 7. What is the maximum difference between shortest and longest path to nil nodes from any node in Red-Black tree?

OR

(b) What is the need to augment any data structure? Write an algorithm to determine the rank of any element from order statistic tree. Find out the rank of element 16 from following order statistic tree (show each iteration, white colored nodes are Red nodes). **07**



Q.3 **(a)** Explain Prim's Algorithm using example. Explain in which case Prim's algorithm is less efficient than Kruskal's algorithm and vice versa. **07**

(b) Find the longest common subsequence from the given two sequences of characters using dynamic programming, **07**

P = (p,r,e,s,i,d,e,n,t); Q= (p,r,o,v,i,d,e,n,c,e)

OR

Q.3 **(a)** Explain with example that how DFS can be useful to detect cycle from the graph. Also give non recursive algorithm for DFS. **07**

(b) Find an optimal solution to the knapsack instance n=4, M=8, (P1,P2,P3,P4)= (3,5,6,10) and (W1,W2,W3,W4)=(2,3,4,5) using backtracking. Explain in which case backtracking is better than dynamic programming. **07**

Q.4 **(a)** Define Binomial heap. Explain the union of two Binomial heaps using suitable example. **07**

(b) Insert the keys F, S, Q, K ,C, L, H, T, V, W, M, R, N, P, A, B, X, Y in order into an empty B-tree of order 5. Prove or disprove: The height h of B-tree of order t is <= $\log_t((n+1)/2)$ in the worst case. **07**

OR

Q.4 **(a)** Explain with example how max-heap can be used to implement priority queue. **07**

(b) Define spurious hits in Rabin-Karp string matching algorithm. Working modulo q=11, how many spurious hits does the Rabin-Karp matcher encounter in the text T = 3141592653589793 when looking for the pattern P = 26? What is worst case processing and matching time complexities of this algorithm? **07**

Q.5 **(a)** Sort the following elements using Radix sort. **07**
453, 89, 702, 428, 388, 25, 970, 167. Which stable sort is used to sort array on digit *i* in Radix sort?

(b) Differentiate between parallel algorithms and sequential algorithms. Write parallel algorithm to find average of n numbers using p processors. **07**

OR

Q.5 **(a)** Sort following elements using parallel merge sort algorithm. Number of available processors are 4. **07**
3, 7, 2, 12, 10, 5, 6, 76, 50, 4, 3, 15. What is the complexity of parallel merge sort algorithm for P available processors?

(b) Explain P and NP-class problems through example. Given the problem to visit every vertex of a graph exactly once, is it NP-complete or NP-hard problem? Justify. **07**

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